REMARKS

Overview of the Office Action

Claims 1-4 have been rejected under 35 U.S.C. §102(e) as anticipated by U.S. Patent 6,734,465 ("Taskar").

Claims 7-9 and 17-21 have been rejected under 35 U.S.C. §103(a) as unpatentable over Taskar.

Claim 5 has been rejected under 35 U.S.C. §103(a) as unpatentable over Taskar in view of U.S. Patent Appl. Pub. No. 2003/0057821 ("Fink").

Claims 11 and 12 have been rejected under 35 U.S.C. §103(a) as unpatentable over Taskar in view of U.S. Patent Appl. Pub. No. 2003/0076454 ("Burroughes").

Claim 10 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Taskar in view of U.S. Patent 6,241,819 ("Bhargava").

Claim 6 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Taskar in view of U.S. Patent Appl. Pub. No. 2003/0032192 ("Haubold").

Claim 13 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Taskar in view of U.S. Patent Appl. Pub. No. 2004/0159846 ("Doxsee").

Status of the claims

Claim 16 has been previously canceled.

Claims 6, 8, 10, 13, and 17-21 have now been canceled.

Claims 14 and 15 have been withdrawn

Claims 1 and 7 have been amended.

Claims 1-5, 7, 9, and 11-12 remain pending.

Rejection of claims 1-4 under 35 U.S.C. § 102(e)

The Office Action states that Taskar teaches all of Applicants' recited elements.

Independent claim 1 has been amended to incorporate the subject matter of dependent claim 13, and now includes the limitation "wherein the nanophosphor is a garnet A3B5012 which is doped with a rare earth element D, the proportion of D being at most 0.9 mol % of a component A of the garnet A3B5012", which the cited references fail to teach or suggest.

With respect to the discussion of dependent claim 13, the Examiner concedes that Taskar fails to teach or suggest the above limitation. However, the Examiner cites paragraphs [0027], [0032], and [0034] of Doxsee as teaching that the nanophosphor is a garnet A2B5O12 and asserts that it would have been obvious to one skilled in the art modify the LED of Taskar to include a nanophosphor that is a garnet A2B5O12.

Even though neither Taskar nor Doxsee teach or suggest that the proportion of D is at most 0.9 mol % of a component A of the garnet A3B5012, the Examiner asserts the concentration of 0.9 mol % for the dopant absent any criticality is considered to be the optimum value determinable by one skilled in the art using routine experimentation. Applicants disagree with the Examiner's assertion and submit that the concentration of a rare earth element D of approximately 0.1 to 1 mol %, and optimally 0.9 mol% of a component A of the garnet A3B5O12 is, in fact, a critical number not determinable by one skilled in the art using routine experimentation.

The declaration submitted concurrently herewith and the graph attached thereto demonstrate the criticality of the claimed Ce-concentration. In Applicants' amended claim 1, the

Ce-concentration is given relative to Y (i.e., A in the garnet A3B5O12). Thus, the values recited in Applicants' claims correspond to the upper abscissa in the attached graph (mol% ≡ at%).

According to the graph, the optical lifetime of YAG is significantly reduced and therefore exhibits strong quenching when the doping of Ce relative to Y is higher than the critical value of 0.9 mol%. That is, the level of quenching is optimized when the doping of Ce relative to Y is less than or equal to the critical value of 0.9 mol%. Also according to the graph, the maximum optical lifetime of 97 ns is achieved only for low doping concentrations of Ce.

It is clear that the optical lifetime of YAG:Ce is shortened with increasing doping of Ce because the possibility of non-radiating energy transfer also increases with increasing doping because the distortion of the crystal lattice of the phosphor is increased. Thus, an increase of non-radiating energy transfer results in a decrease of emission efficiency. Non-radiating energy transfer is not useful when radiation (emission) is required, as in an LED. Stated another way, the longer the optical lifetime, the greater the phosphor emission efficiency. The above-described luminescence quenching at such a low Ce concentration occurs only with YAG nanophosphors. Thus, the Ce concentration is optimized at 0.9 mol% as described above.

It is important to note that although paragraph [0034] of Doxsee cited by the Examiner teaches a garnet A3B5O12, the garnet of Doxsee is Terbium Aluminum Garnet (TAG), and not Yttrium Aluminum Garnet, as used in Applicants' recited invention. The above-described luminescence quenching at a Ce concentration of 0.9 mol% does not occur with TAG nanophosphors, and therefore the concentration of Ce of 0.9 mol% is not applicable with TAG:Ce and would not be determinable by one skilled in the art using routine experimentation.

As further discussed in the inventor's declaration, an advantage of the YAG nanophosphors with Ce concentrations below 1 mol % and greater than 0.1 mol % is that

chromaticity points lying in the green spectral range can be attained (i.e., the maximum emission of the phosphor (i.e., emission peak) shifts toward short-wave wavelengths) without significant efficiency loss (i.e., scattering is negligible) so that the absorption curve of the YAG:Ce lies under the peak wavelength of 460 nm of the primary emission source (i.e., the InGaN chip), and thereby, when put together with a second, red phosphor, enables high quality white light to be produced.

In view of the above, the criticality of 0.9 mol% concentration of Ce relative to YAG has been clearly shown, and Taskar and Doxsee, whether taken alone or in combination, fail to teach or suggest "wherein the nanophosphor is a garnet A3B5012 which is doped with a rare earth element D, the proportion of D being at most 0.9 mol % of a component A of the garnet A3B5012", as now expressly recited in Applicants' amended independent claim 1. Accordingly, claim 1 is deemed to be patentable over Taskar and Doxsee under 35 U.S.C. §102(e) and §103(a).

Dependent claims

Claims 2-4, which depend from independent claim 1, incorporate all of the limitations of independent claim 1 and are, therefore, deemed to be patentably distinct over Taskar and Doxsee for at least those reasons discussed above with respect to independent claim 1.

Rejection of claims 7-9 and 17-21 under 35 U.S.C. §103(a)

The Office Action states that Taskar teaches all of Applicants' recited elements.

Taskar has been previously discussed and fails to teach or suggest the subject matter recited in Applicants' independent claim 1.

Independent claim 7 has been amended to incorporate limitation similar to independent claim 1 and is, therefore, and is, therefore, deemed to be patentably distinct over Taskar for at least those reasons discussed above with respect to independent claim 1.

Claims 8 and 17-21 have been canceled. Claim 9, which depends from independent claim 1, incorporates all of the limitations of independent claim 1 and is, therefore, deemed to be patentably distinct over Taskar for at least those reasons discussed above with respect to independent claim 1.

Rejection of claim 5 under 35 U.S.C. § 103(a)

The Office Action states that the combination of Taskar and Fink teaches all of Applicants' recited elements.

Taskar has been previously discussed and fails to teach or suggest the subject matter recited in Applicants' independent claim 1.

Because Taskar fails to teach or suggest the subject matter recited in independent claim 1, and because Fink fails to teach or suggest the subject matter recited in independent claim 1 that Taskar is missing, the addition of Fink to the reference combination fails to remedy the above described deficiencies of Taskar.

Claim 5, which depends from independent claim 1, incorporates all of the limitations of independent claim 1 and is, therefore, deemed to be patentably distinct over Taskar and Fink for at least those reasons discussed above with respect to independent claim 1.

Rejection of claims 11 and 12 under 35 U.S.C. §103(a)

The Office Action states that the combination of Taskar and Burroughes teaches all of Applicants' recited elements.

Taskar has been previously discussed and fails to teach or suggest the subject matter recited in Applicants' independent claim 1.

Because Taskar fails to teach or suggest the subject matter recited in independent claim 1, and because Burroughes fails to teach or suggest the subject matter recited in independent claim 1 that Taskar is missing, the addition of Burroughes to the reference combination fails to remedy the non-obviousness of claim 1.

Claims 11 and 12, which depend from independent claim 1, incorporate all of the limitations of independent claim 1 and are, therefore, deemed to be patentably distinct over Taskar and Burroughes for at least those reasons discussed above with respect to independent claim 1.

Rejection of claim 10 under 35 U.S.C. § 103(a)

The Office Action states that the combination of Taskar and Bhargava teaches all of Applicants' recited elements. Claim 10 has been canceled. Therefore, this rejection is now moot.

Rejection of claim 6 under 35 U.S.C. § 103(a)

The Office Action further states that the combination of Taskar and Harbold teaches all of Applicants' recited elements. Claim 6 has been canceled. Therefore, this rejection is now moot.

Rejection of claim 13 under 35 U.S.C. § 103(a)

The Office Action further states that the combination of Taskar and Doxsee teaches all of Applicants' recited elements. Claim 13 has been canceled. Therefore, this rejection is now moot.

Conclusion

In view of the foregoing, Applicants respectfully request reconsideration, withdrawal of the rejections, and allowance of all of the now-pending claims.

Should the Examiner have any comments, questions, suggestions, or objections, the Examiner is respectfully requested to telephone the undersigned to facilitate a resolution of any outstanding issues.

Respectfully submitted,
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